

## CLAIMS

What is claimed is:

1. A method for detecting an analyte within a sample, comprising the steps of:  
providing a substrate having a plurality of spaced-apart targets configured to bind the analyte;  
sequentially directing an optical signal at each of the plurality of spaced-apart targets;  
and  
detecting the presence of the analyte with an interferometer.
2. The method of claim 1, wherein the plurality of spaced-apart targets are arranged in a track and wherein the step of sequentially directing an optical signal at each of the plurality of spaced-apart targets comprises the steps of:  
providing an optical source configured to generate the optical signal;  
aligning the optical signal with the track; and  
spinning the substrate such that the optical signal is sequentially directed at each of the plurality of spaced-apart targets of the track.
3. The method of claim 2, wherein the optical signal is sized to illuminate at least a portion of at least one of the targets and a portion of the substrate surrounding the at least one target.
4. The method of claim 3, wherein the at least one target is at a first height and the portion of the substrate surrounding the target is at a second height that is different from the first height.
5. The method of claim 4, wherein the optical signal generates a first diffraction signal when the analyte is bound to the target and a second diffraction signal when the analyte is not bound to the target, the second diffraction signal being distinguishable from the first diffraction signal.
6. The method of claim 1, wherein the interferometer is an adaptive interferometer.

7. The method of claim 6, wherein the plurality of spaced-apart targets are arranged in a track and wherein the step of sequentially directing an optical signal at each of the plurality of spaced-apart targets comprises the steps of:
  - providing an optical source configured to generate the optical signal;
  - aligning the optical signal with the track; and
  - spinning the substrate such that the optical signal is sequentially directed at each of the plurality of spaced-apart targets of the track.
8. The method of claim 6, wherein the plurality of spaced-apart targets include an antibody configured to bind the analyte.
9. The method of claim 8, wherein the plurality of spaced-apart targets are separated by reference blanks.
10. The method of claim 8, wherein the plurality of spaced-apart targets are separated by a blocking which is configured to not bind the analyte.
11. The method of claim 10, wherein the antibody configured to bind the analyte is stamped onto the substrate.
12. A device for identifying a first analyte of a group of analytes in a biological sample, including:
  - a substrate including a first plurality of spaced-apart regions configured to bind the first analyte;
  - an optical source configured to generate a probe beam which illuminates the first plurality of spaced-apart regions in a sequential manner and interacts with the substrate to form a signal beam;
  - an interferometer configured to combine with an adaptive optical element a reference beam and the signal beam, the combination of the reference beam and the signal beam generating an output beam; and

a detector configured to detect the presence or absence of the first analyte based upon the output beam.

13. The device of claim 12, wherein the probe beam is reflected by the substrate to form the signal beam.

14. The device of claim 12, wherein the probe beam is transmitted through the substrate to form the signal beam.

15. The device of claim 12, wherein each of the first plurality of spaced-apart regions is separated from another of the first plurality of spaced-apart regions by one of a second plurality of regions configured to not bind the first analyte.

16. The device of claim 12, wherein the substrate includes a plurality of concentric tracks spaced such that the probe beam illuminates a single track, the first plurality of spaced-apart regions being disposed on the plurality of concentric tracks.

17. The device of claim 16, further comprising a motor configured to spin the substrate such that the probe beam is sequentially incident on the first plurality of spaced-apart regions of a first track, and a controller configured to control on which track of the plurality of tracks the probe beam is incident.

18. The device of claim 12, wherein the interferometer operates in a quadrature condition.

19. A substrate configured to bind a plurality of analytes and for use with a detection system configured to illuminate the substrate with a probe beam and to determine the presence of one of the analytes on the substrate based on the characteristics of a probe beam subsequent to interacting with the substrate, the substrate comprising:

a circular track including a plurality of spaced-apart targets configured to bind to one analyte, the plurality of spaced-apart targets being separated by a plurality of regions configured to not bind the one analyte; and

wherein the plurality of spaced-apart targets and the plurality of regions together are configured to alter the characteristics of the probe beam to produce a first signal when the one analyte is bound to the plurality of spaced-apart targets and to alter the characteristics of the probe beam to produce a second signal when the one analyte is not bound to the plurality of spaced apart targets.

20. The substrate of claim 19, wherein the plurality of targets of the track each includes a specific analyzer molecule configured to bind the one analyte.

21. The substrate of claim 19, wherein the plurality of targets of the track are at a first height and the plurality of regions of the track are at a second height, the second height being different from the first height.

22. The substrate of claim 21, wherein a height difference between the first height and the second height is approximately one-eighth of a wavelength of the probe beam.

23. The substrate of claim 21, wherein a height difference between the first height and the second height is approximately one-fourth of a wavelength of the probe beam.

24. A device for identifying an analyte in a biological sample, including:  
a substrate including a first region configured to bind the analyte upon introduction of the biological sample to the substrate and a second region configured to not bind the analyte;  
a motor configured to spin the substrate;  
a laser including a beam which is directed at the substrate such that the beam interacts with the first region and the second region as the substrate spins; and  
a sensor configured to detect a portion of the beam subsequent to the beam interacting with the substrate, the sensor indicating the presence of the analyte based on an interference characteristic of the beam subsequent to the beam interacting with the substrate, the beam having a first interference characteristic if the analyte is bound to the substrate and a second interference characteristic if the analyte is not bound to the substrate.

25. The device of claim 24 wherein the substrate includes a plurality of first regions and a plurality of second regions.
26. The device of claim 25 wherein the each of plurality of first regions and the plurality of second regions are arranged in an alternating pattern and such that the plurality of first regions and the plurality of second regions form a circular track on the substrate.
27. The device of claim 25 wherein the each of plurality of first regions and the plurality of second regions are arranged in an alternating pattern and each of the plurality of first regions and the plurality of second regions form radially extending spokes on the substrate.
28. The device of claim 27 wherein the plurality of first regions and the plurality of second regions are formed on the substrate by microfluidic printing.
29. The device of claim 24 wherein the substrate includes a plurality of circular concentric tracks, each track including a plurality of first regions and a plurality of second regions, the plurality of first regions and the plurality of second regions being arranged in a repeating pattern.
30. The device of claim 24 wherein the sensor comprises an interferometer configured to combine the portion of the beam subsequent to the beam interacting with the substrate and a reference beam to produce an interference pattern, and a detector configured to provide an indication of the presence or absence of the analyte based at least in part on the interference pattern.
31. The device of claim 30 wherein the portion of the beam subsequent to the beam interacting with the substrate is reflected by the substrate.
32. The device of claim 20 wherein the portion of the beam subsequent to the beam interacting with the substrate is transmitted through the substrate.

33. The device of claim 30 wherein the interferometer includes an adaptive holographic element.
34. The device of claim 24 wherein the beam is generally normal to a surface of the substrate and the first region has a first height and the second region has a second height, the second height being offset relative to the first height.
35. The device of claim 34 wherein the second height is offset relative to the first height by approximately one-eighth of a wavelength of the beam.
36. The device of claim 34 wherein the second height is offset relative to the first height by approximately one-fourth of a wavelength of the beam.
37. A device for identifying analytes in a biological sample, including:  
a substrate having a surface lying substantially in a first plane, a plurality of targets offset vertically from the substrate surface, each of the targets having a wall lying substantially in a second plane, one of the surface and the walls of the targets being configured to bind analytes present in the biological sample when the biological sample is introduced to the substrate; and  
a laser for sequentially directing a beam at each of the plurality of targets, the laser being positioned relative to the substrate such that when the beam is directed at a target an interference characteristic is produced.
38. The device of claim 37 wherein a first portion of the beam interacts with the target wall and a second portion of the beam interacts with a portion of the substrate adjacent the target, the first and second portions being combined to produce a diffraction signal, the diffraction signal has a first value when an analyte is not bound to the substrate and a second value when an analyte is bound to the substrate, thereby indicating the presence of the analyte.
39. The device of claim 38 wherein the diffraction signal includes the first portion of the beam reflected from the substrate and the second portion of the beam reflected from the

substrate.

40. The device of claim 38 wherein the diffraction signal includes the first portion of the beam transmitted through the substrate and the second portion of the beam transmitted through the substrate.

41. A method for detecting the presence of an analyte in a sample, comprising the steps of:

providing a substrate having a plurality of first regions configured to bind the analyte and a plurality of second regions configured to not bind the analyte;

spinning the substrate;

introducing the sample proximate the center of the substrate and continuing to spin the substrate such that an incubation time for the sample is generally diffusion limited;

directing a laser beam at the substrate such that the laser interacts with the substrate;

and

determining the presence of the analyte based at least in part on a characteristics of laser beam subsequent to interaction with the substrate.

42. The method of claim 41 wherein the step of determining the presence of the analyte based at least in part on a characteristics of the portion of the laser beam subsequent to interaction with the substrate includes of the steps of

combining the portion of the laser beam subsequent to interaction with the substrate with a reference beam, such that the portion of the laser beam subsequent to interaction with the substrate and the reference beam create an interference pattern;

locating an adaptive element such that the interference pattern interacts with the adaptive element, the adaptive element generating at least a first output signal; and

detecting the first output signal.

43. The method of claim 41 wherein the plurality of first regions are formed on the substrate by microfluidic printing.

44. The method of claim 41 wherein the plurality of first regions are formed on the substrate by ink jet printing.